Analyzing Semantic-Pragmatic Processing of Scalar Implicatures in Typically-Developing Children

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Background

Logical and Implicature 'some'

- The quantifier *some* can have both a logical, "some, and possibly all" meaning or a pragmatically enriched "some, but not all" meaning, derived by conversational, scalar implicature (Grice 1975).
- These interpretations arise as a function of pragmatic context and syntactic context.
- Sentence 1 shows the logical interpretation while sentence 2 shows the pragmatically enriched meaning.

1. If some players make a goal, you owe me lunch.
   .....and all of them did, so you owe me lunch.
2. Yesterday some players made a goal.
   .....and others did not.

- Less talked about in the literature on what adults know of these interpretations is the fact that the phonetic form of the quantifier tends to align with particular interpretations.
  - A no vowel version of *some*, written 'sm' in Milsark (1977), tends to get the logical interpretation.
  - The pitch-accented, full vowel version, which I will write as SOME, tends to be interpreted as the pragmatically enriched "some, but not all" (Thorward 2009).

Existentials In Child Language

- Research into children's understanding of existentials has reached virtually all of the possible conclusions regarding whether or not children have adult-like knowledge of the pragmatic-logical distinction in existential quantifier interpretation:
  - Children do not understand the logical meaning (Beilin & Lust 1975, Johansson 1977).
  - Children understand the logical meaning, but not the pragmatic meaning (Noveck 2001, Chevalier, Noveck, Happe & Wilson 2009)
  - Children understand both the logical and the pragmatic meaning, if pragmatic context is controlled (Chierchia et al 1998, Chierchia et al 2001, Guasti et al 2005, Papafragou & Tantalou 2004, Munn et al 2005)
- None of the existing research carefully controls the phonetic variants of *some*.
- Earlier work (Thorward 2009, Grinstead et al 2010) showed that preschool children do not appear to attend to pitch in distinguishing among three version of *some*, but rather duration.
- The same question has not been asked of school-aged children.

Questions

General

What impact do the phonetic properties of these quantifiers have on their Interpretations?

Specific

1. For adults, which interpretation of *some* will arise when it occurs with a pitch accent, which tends to generate implicatures, in a downward entailing syntactic context, which tends to cancel implicatures?
2. Are school-aged English-speaking children able to attend to pitch and not just duration, as preschool children appear to?

Experiment 1 (with Liana Martínez)

Question

Do adults cancel "some, but not all" implicatures with pitch accented SOME in downward entailing contexts?

Methods

Participants: 35 monolingual, English-speaking adults (Age range = 18:0-22:0 , Mean Age = 20:3). 6 adults did not pass both fillers, and were excluded from the study.

Materials: The experiment was administered using Eprime on a computer monitor using headphones. EPrime recorded the participants' yes-no responses, using a button box, as well as their reaction time. Video-recorded trials were created for a previous project (Thorward 2009), using a lion puppet, a panda puppet, a barn, a fence, and 8 sets of plastic animals.

Procedures

This experiment used a Truth Value Judgment Task in a between-subjects design. Adults were asked to answer questions as quickly as possible, listen to "Sam" the lion puppet and to judge the correctness of Sam's description of the scenario. There were four target sentences, two training sentences, and two control sentences. Adults were required to pass both control sentences to be included in the study.

Acknowledgements

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Experiment 1 (contd)

Stimuli

There were eight sentences with animals jumping over a fence. Participants were assigned to a condition in which they heard only 1 of the 3 phonetic variants of *some*, as pilot attempts, reported in Thorward (2009), to test phonetic variants within subjects failed.

Four target sentences were declaratives presented after a video in which either 3 or 4 of 4 animals jumped over a fence:

Implicature Generating Context

- Sm/some/SOME cats jumped over the fence.

The other two of the four target sentences appeared in a downward-entailing environment, the antecedent of a conditional sentence:

Implicature Canceling Context

- If sm/some/SOME cats jump over the fence, you owe me a quarter.

There were also two control sentences using the words "all" and "none" with either 0 of 4 or 3 of 4 animals jumping over a fence, preceded by two training sentences with 4 of 4 or 3 of 4 animals jumping over the fence, also with the words "all" or "none".

The three variants of *some* tested were significantly different from one another by pitch and variation.

- SOME has a higher pitch than some ($p < .001$) and SOME has a higher pitch than sm ($p=.001$).
- SOME has a longer vowel than some ($p < .001$)
- SOME is a longer word than sm ($p = 0033$)

Three Types of *Some*

Variant of some	Word Duration (s)	Vowel Duration (s)	Maximum Pitch (Hz)
sm	.301	n/a	297.7
some	.350	.139	273.2
SOME	.398	.154	471.2

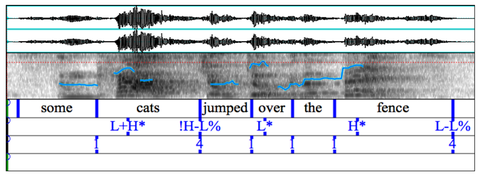


Fig 1. *Sm* cats jumped over the fence

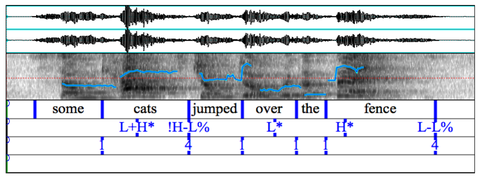


Fig 2. *Some* cats jumped over the fence

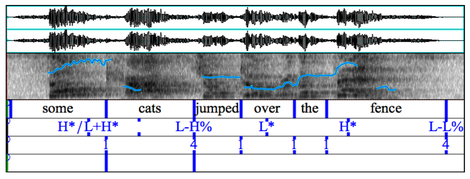
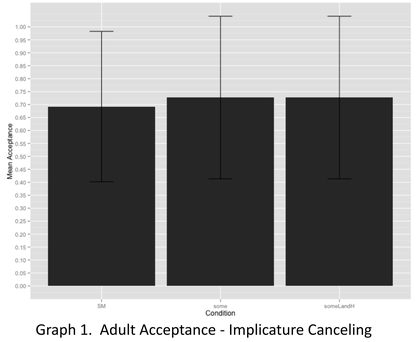


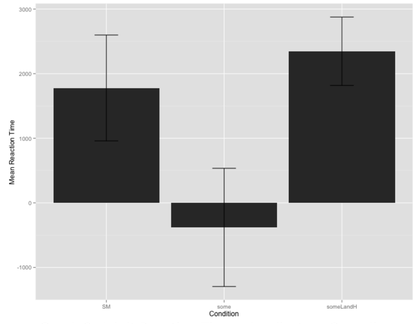
Fig 3. *SOME* cats jumped over the fence

Results

- Adults canceled implicatures with a pitch-accented SOME, though not significantly more or less than with the other two types ($p < .05$).
- With respect to reaction time, adults seem to process the standard variant of *some* (no pitch accent, but with a full vowel), faster than the two phonetically marked versions *sm* and *SOME* (1-way ANOVA, $f(2)=15.739$, $p < .001$).
- *some* is faster than *sm*, $p < .001$, and *some* is faster than *SOME*, $p < .001$, by post-hoc test.



Graph 1. Adult Acceptance - Implicature Canceling



Graph 2. Adult Reaction Time – Implicature Canceling

Discussion

- Adults, in this data, did not appear to cancel implicatures less as a function of the phonetic cues of duration and pitch.
- In contrast, their reaction times were much shorter with the standard version of *some* than either of the phonologically marked versions
- Perhaps something about processing the phonetic cues of pitch and duration slows adult interpretations.

Experiment 2

Methods

Participants: 23 monolingual, English-speaking children (Age range =71months to 107 months), Mean Age =84.3 months). Children were required to have complete IRB consent forms signed by their guardian, and fall within the norm of two standardized tests: a language test (the CELF-4) and a nonverbal IQ test (the KBIT-2). 10 children were outside of the norm and 6 of children did not pass the fillers within the experiment, and were excluded from the study.

Materials: Identical to Experiment 1.

Procedures

The procedure was identical to Experiment 1. Children were instructed to listen and answer as quickly as possible if they thought the lion puppet ("Sam") and the panda puppet ("Bill") were correct or not.

The stimuli were identical to Experiment 2.

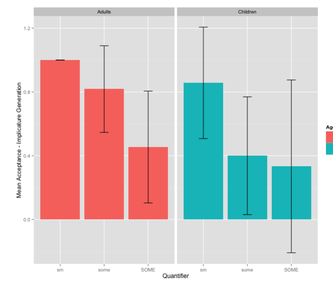
Questions

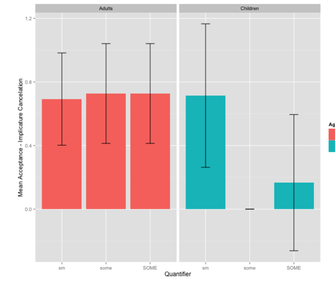
In earlier work (Thorward 2009, Grinstead et al 2010), preschool children appeared to attend to duration and not pitch, in contrast to an adult control group, in interpreting variants of *some*.

Do older children appear more adult-like in using both pitch and duration to interpret phonetic variants of *some*?

Results

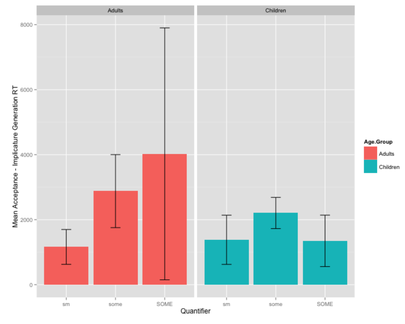
- Children are not different from adults in their judgments of *sm* and *SOME* in implicature generating contexts ($p < .05$), but are different with respect to *some* (chi-square (1) = 3.884, p = .049).
- These results are similar to those of Thorward (2009), who argued that children paid attention to duration, in that long words (*some* and *SOME*) generated implicatures, while the short variant (*sm*) does not.
- Also similar to Thorward's preschool children, our 5-8 year-olds generate more implicatures in downward entailing contexts with *some* (chi-square (1) = 11.748, p = .001) and *SOME* (chi-square (1) = 4.898, p = .027) than adults do, but not with *sm* ($p < .05$).

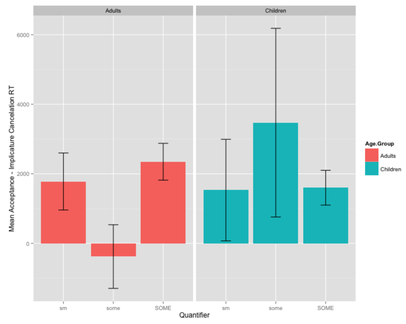




- With respect to reaction time for adults, there were no significant differences in Implicature Generation among the three variants of *some*, in my data, but adults were significantly faster in Implicature Cancelation with *some* than they were with *sm* or *SOME* ($f(2)=15.739$, $p < .001$, also $p <.001$ for post-hoc *sm* vs. *some* and *sm* vs. *SOME*.)

- For the children, in the Implicature Generation condition, *some* took significantly longer than either *sm* ($p = .035$)or *SOME* ($p = .036$). There were no significant differences in the Implicature Cancelation condition, yet the data appeared to trend in the same direction.





Discussion

- Accuracy results suggest that the roughly 7 year-old children in our sample, like the 5 year-old children in Thorward's (2009) sample, appear to depend on duration as a phonetic cue, instead of pitch, to signal pragmatic implicatures.
- Also as in Thorward's preschool sample, our school-aged children generated more implicatures in the implicature canceling condition than adults did, except with *sm*. This ability to look adult-like with *sm* in implicature canceling contexts is probably what underlies their apparently adult-like behavior in previous work (e.g. Chierchia 2001).
- An intriguing result is the difference in reaction time between adults and children with *some* in the Implicature Canceling condition. Since *some* is the most frequent variant of "some" (Thorward 2009), it is interesting that the children in our sample are so much slower than adults.